Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

# CONTRAPOSED SHORELINES[1]

CHARLES H. CLAPP
Geological Survey of Canada, Ottawa

When a shoreline which has been cut in a soft mantle covering hard rocks is, through the complete retrogression of the mantle, placed against the hard rocks, it changes radically, since it becomes dependent on the character of the hard rock surface which was covered by the soft mantle. The development of this type of shoreline is analogous to the development of superposed valleys, and in referring to the type it is desirable to use some term that shall suggest this analogy. The simplest and most evident seems to be the term contraposed,[2] meaning placed against (superposed meaning placed upon).

By the development of a contraposed shoreline, a shoreline may change during a single cycle from mature to youthful. Early in the cycle when the shoreline is cut in the soft mantle it must be simple, nearly straight, and cliffed, submature to mature. As retrogression proceeds the soft mantle is pushed back to the hard rocks and gradually, since the hard rocks are more resistant, is retrograded beyond them. At such a point in the cycle the shoreline is entirely in the hard rock. Hence it is identical to one developed by the depression of a hard rock surface, and is consequently in a youthful stage.

The accompanying block diagram illustrates three stages in the development of a contraposed shoreline. The far block indicates the conditions existing during the early part of the cycle, when the shoreline is cut in the soft mantle. The middle block indicates the conditions when the mantle is retrograded in places beyond the hard

---

[1] Published with the permission of the Director of the Geological Survey of Canada. Acknowledgment is due Professors W. M. Davis and D. W. Johnson who suggested that I devise a name for the type of shoreline described.

[2] As superimposed has recently and conveniently been contracted to superposed, contraposed is preferable to contraimposed.

rocks. The front block illustrates the conditions existing after the complete retrogression of the soft mantle.

Near Victoria, British Columbia, the development of contraposed shorelines may be seen in all stages, and a short description of them will be pertinent to the introduction of the term contraposed. Apparently the depression and subsequent partial recovery of the submaturely glaciated and drift-covered crystalline rock lowland of southeastern Vancouver Island initiated the present marine cycle. The initial shoreline must have been rather simple, with smooth flowing outlines where the crystalline rocks were drift covered, but in a few places where the glaciated rock surfaces were not drift covered, it must have been characterized by many small rounded and smoothed irregularities.

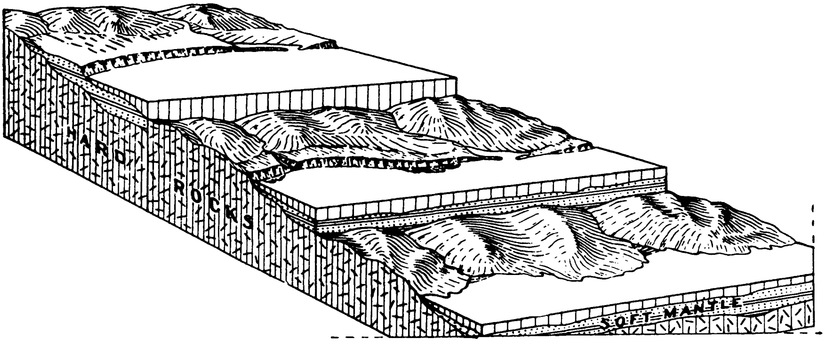

FIG. 1.—Block diagram illustrating the development of a contraposed shoreline

During the present marine cycle the shore has been subjected to moderately strong erosion and the uplifted drift deposits have been rapidly retrograded to form sea-cliffs 200 to 250 feet high with sandpits and bars, and in places, as on the west shore of Royal Roads (see Fig. 2), a nearly straight, mature shoreline. In many instances as along the shore south of Victoria, the drift has been retrograded in places beyond the underlying crystalline rocks. These form small sub-sharp to rounded points, which project beyond the even-cliffed shoreline, the drift-cliff now occurring a few feet or yards back of high-water mark (see Fig. 3). In still other instances, as on the shore of Esquimalt peninsula (see Fig. 2), the drift has been completely retrograded and the result is a very young, contraposed shoreline. Hardly any of the initial irregularities have been destroyed. On the contrary in the sheared zones, dikes, and interbedded softer rocks small coves and wave-chasms have been cut. The hard rocks themselves have not been beached, but since the retrograded drift deposits frequently occur between headlands of hard rock, there are narrow beaches composed of their material in the protected places of the headlands.

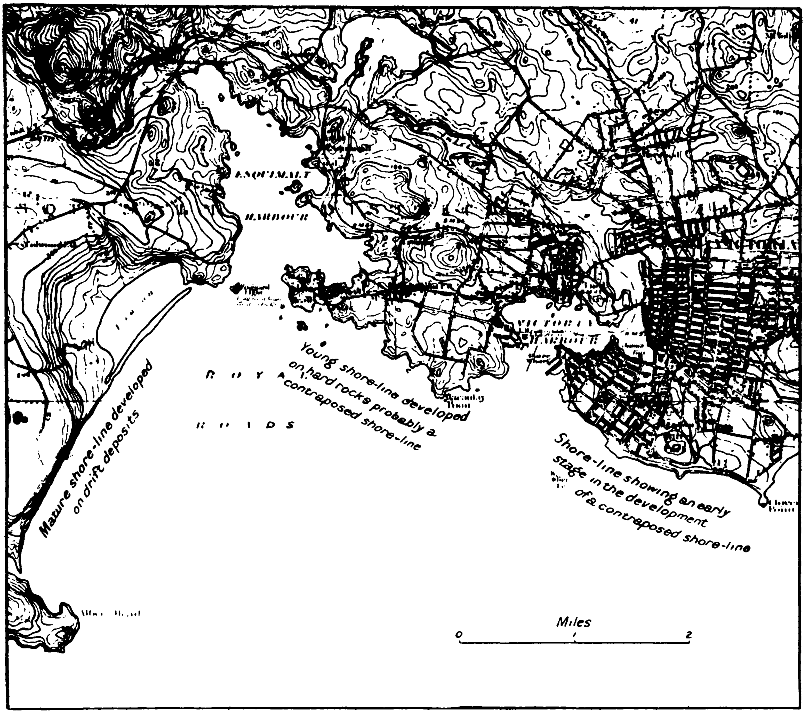
ESQUIMALT
HARBOUR
ROYAL
ROADS
VICTORIA
HARBOUR
Mature shore-line developed on drift deposits
Young shore-line developed on hard rocks probably a contraposed shore-line
Shore-line showing an early stage in the development of a contraposed shore-line
Miles
0
1
2

FIG. 2.—Part of the Victoria topographic sheet, Geological Survey of Canada

It has been objected to the term contraposed, that it could not be applied on a large scale, that is, that contraposed shorelines would always be very limited in extent. This is more or less true; although one can imagine an extensive contraposed shoreline formed by the retrogression of an extensive coastal plain deposit back to the older and presumably harder rocks on which the coastal plain deposits were laid down. There are, however, no mapped, good and clear examples of such a shoreline, although much of the Pacific shoreline of North America from Vancouver Island south, may be of this character, since even where the shoreline is cut almost entirely in hard rocks, there are remnant patches of coastal plain deposits; while between the stretches of rocky shoreline are long reaches of mature shoreline cut in extensive coastal plain deposits. The development of the Pacific Coast shoreline has, however, been complex, while the development of an ideal contraposed shoreline is simple, taking place during a single cycle, during which there is, of course, a still stand of the land. But on a relatively small scale, contraposed shorelines are so very frequent in occurrence and so strongly marked and easily recognized, that some generally accepted term for them will be a great convenience.

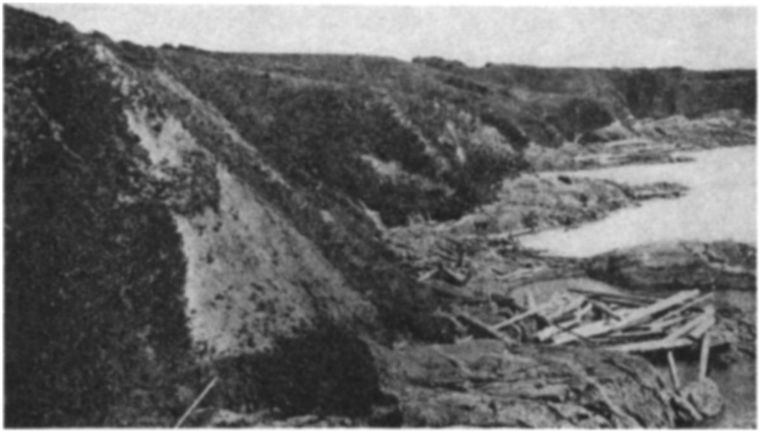

FIG. 3.—Contraposed shoreline, showing hard rocks overlain by retrograded soft mantle. Shore south of Victoria, British Columbia.